King Saud University
Collage of Computer and Information Science
Computer Science Department

CSC 311 – Term 432

Date: Tuesday February 8, 2022

Quiz 1

Duration: 30 Minutes

Student Name: [redacted]

Section: [redacted]

Student ID: [redacted]

Serial Number [redacted]

Grade: [redacted]

Question 1 [2 /2 Points]

Use the formal definition of θ to prove that $\mathbf{2n^3 - 7n + 1 \in \theta(n^3)}$. Provide appropriate $\mathbf{c_1, c_2,}$ **and** $\mathbf{n_0}$ constants. Show all steps required.

$c_1 n^3 \geq 2n^3 - 7n + 1 \geq c_2 n^3$

prove big-O:

$\frac{2n^3 - 7n + 1}{n^3} \leq \frac{c_1 n^3}{n^3} \quad \forall n \geq n_0$

$2 - \frac{7}{n^2} + \frac{1}{n^3} \leq c$

→ ignor - term in ($\leq$)

$= 2 + \frac{1}{n^3} \leq c$

$n_0 = 2, c_1 = 3 \rightarrow \forall n \geq 1$

عشان مايكون الايسر سالب

prove Ω:

$3n^3 - 7n + 1 \geq c_2 n^3$

$3 - \frac{7}{n^2} + \frac{1}{n^3} \geq c_2$

$n_0 = 3, c_2 = 3 - \frac{7}{4} + \frac{1}{18}$

$c_1 = 3, c_2 = 3 - \frac{7}{4} + \frac{1}{18}, n_0 = 3$

Question2 [1 /1 Point]

Use limits of rational functions to prove that $(n) = 7n^2 + 3n\,logn + 5n + 100 \in \theta(n^2)$. Show all steps required.

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$\lim_{n \to \infty} \frac{7n^2 + 3n\log n + 5n + 100}{n^2} = \lim_{n \to \infty} \frac{\cancel{7n^2}}{\cancel{n^2}} = \cancel{7}$

↓

constant

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Question3 [1.65 /2 Point]

For each blank, indicate whether A_i is in O or/and Ω of B_i . More than one space per row can be valid. No explanation is required.

Note: $\ln n = \log_e n$.

A	B	$A = O(B)$	$A = \Omega(B)$
n^3	n^2	No	yes
$0.0000001\, n^3$	$5000n(n+1)$ $n^2 + n$	NO	yes
$log^7 n$	$n^{0.7} \rightarrow \sqrt{n}$	yes	yes -0.1
$\ln n$	$\log n$	yes	yes
$\left(\frac{12}{13}\right)^n$ >	$\left(\frac{13}{12}\right)^n$	No	yes -0.25
$\sqrt{n} \rightarrow 0.5$ <	$log^2 n$	yes -0.1	yes
$\log(n!)$ <	$\log(n^n)$	yes	NO